SPRING 2008 COLLOQUIUM SEMINAR

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“Colloids as building blocks: anisotropy and its effect on particle assembly”

Assemblies of colloidal particles abound in nature as well as in technological products and processes. For example, colloidal particle gels are the basis of structured complex fluids like inks and scaffolds; shock absorbers exploit the shear thickening response of amorphous colloidal packings; and colloidal crystal arrays are the structure of natural opals as well as the basis for sensors and advanced optical materials. In most cases, colloidal assemblies are comprised of spherical particles with isotropic interactions. Although engineering the strength and range of colloidal forces in these cases affects assembly, the diversity of structures that can be accessed is limited – much less than in molecular systems. To increase possibilities for colloidal assembly we must produce colloidal building blocks that move beyond the isotropic shape and interactions that are typical. Thus, fabrication of particles with controlled anisotropy is key for emergent applications in assembly. Here we discuss two methods for the production of anisotropic particles and their application to colloidal assembly. The first method produces anisotropic particles by stretching initially spherical colloids into rods. Upon sedimentation, these rods form liquid crystal phases whose orientational order we study with confocal microscopy. The second method uses microfluidic processing to combine both shape and material anisotropy in the same particle. The method has been used to synthesize linear chains and triangular prisms with homogeneous (ie “A”) and heterogeneous (ie “A-B” and “A-B-A”) structure. These anisotropic particles contain specifically designed bond angles and compositions. We discuss how the complex anisotropy of these new kinds of colloidal particles can be rationalized and thereby harnessed in the pursuit of new kinds of colloidal structures.

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Location: 825 Mudd

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